National Institute of Environmental Health Sciences

# Atlanta's urban heat island under extreme heat conditions and potential mitigation strategies

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**Abstract:**

The urban heat island (UHI), together with summertime heat waves, foster's biophysical hazards such as heat stress, air pollution, and associated public health problems. Mitigation strategies such as increased vegetative cover and higher albedo surface materials have been proposed. Atlanta, Georgia, is often affected by extreme heat, and has recently been investigated to better understand its heat island and related weather modifications. The objectives of this research were to (1) characterize temporal variations in the magnitude of UHI around Metro Atlanta area, (2) identify climatological attributes of the UHI under extremely high temperature conditions during Atlanta's summer (June, July, and August) period, and (3) conduct theoretical numerical simulations to quantify the first-order effects of proposed mitigation strategies. Over the period 1984-2007, the climatological mean UHI magnitude for Atlanta-Athens and Athens-Monticello was 1.31 and 1.71A degrees C, respectively. There were statistically significant minimum temperature trends of 0.70A degrees C per decade at Athens and -1.79A degrees C per decade at Monticello while Atlanta's minimum temperature remained unchanged. The largest (smallest) UHI magnitudes were in spring (summer) and may be coupled to cloud-radiative cycles. Heat waves in Atlanta occurred during 50% of the years spanning 1984-2007 and were exclusively summertime phenomena. The mean number of heat wave events in Atlanta during a given heat wave year was 1.83. On average, Atlanta heat waves lasted 14.18 days, although there was quite a bit of variability (standard deviation of 9.89). The mean maximum temperature during Atlanta's heat waves was 35.85A degrees C. The Atlanta-Athens UHI was not statistically larger during a heat wave although the Atlanta-Monticello UHI was. Model simulations captured daytime and nocturnal UHIs under heat wave conditions. Sensitivity results suggested that a 100% increase in Atlanta's surface vegetation or a tripling of its albedo effectively reduced UHI surface temperature. However, from a mitigation and technological standpoint, there is low feasibility of tripling albedo in the foreseeable future. Increased vegetation seems to be a more likely choice for mitigating surface temperature.

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## Resource Description

**Communication:**

resource focus on research or methods on how to communicate or frame issues on climate change; surveys of attitudes, knowledge, beliefs about climate change

A focus of content

**Communication Audience:**

audience to whom the resource is directed

Policymaker

**Exposure :**

weather or climate related pathway by which climate change affects health

Temperature

**Temperature:** Extreme Heat

**Geographic Feature:**

resource focuses on specific type of geography

Urban

**Geographic Location:**

resource focuses on specific location

United States

**Health Impact:**

specification of health effect or disease related to climate change exposure

Injury

**Mitigation/Adaptation:**

mitigation or adaptation strategy is a focus of resource

Adaptation

**Model/Methodology:**

type of model used or methodology development is a focus of resource

Exposure Change Prediction

**Resource Type:**

format or standard characteristic of resource

Research Article

**Timescale:**

time period studied

Time Scale Unspecified

**Vulnerability/Impact Assessment:**

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content